PLC Based Automatic Wire Stirrup Bender

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2018

Faculty of Engineering Sciences and Technology
Hamdard Institute of Engineering and Technology
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Under the supervision of
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A project presented to the

Faculty of Engineering Sciences and Technology

Hamdard Institute of Engineering and Technology

In partial fulfillment of the
requirements for the degree of

Bachelors of Engineering

In

Electronics

Faculty of Engineering Sciences and Technology
Hamdard Institute of Engineering and Technology
Hamdard University, Main Campus, Karachi, Pakistan

Faculty of Engineering Sciences and Technology

Hamdard Institute of Engineering and Technology

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CERTIFICATE

This project **"PLC Based Automatic Wire Stirrup Bender"** presented by **Sayed Sardar Shah, Amir Taj Khan** and **Naveed Manzoor Afridi** under the direction of their project advisor's and approved by the project examination committee, has been presented to and accepted by the Hamdard Institute of Engineering and Technology, in partial fulfillment of the requirements for Bachelor of Engineering (Electronics).

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ABSTRACT

The report, titled “PLC Based Automatic Wire Stirrup Bender” follows and expands on the eponymous Final Year Project carried out by a group of three students from Electronics Engineering department, Batch Spring 2015. For demonstration depends on “PLC Based Automatic Wire Stirrup Bender”. Its operation can be divided into three parts:

1. Feeding
2. Bending
3. Cutting
4. PLC controller System
5. HMI

There a lots of shapes like simple shapes, sensitive’s shapes and complex shapes. Hence to get the proper shapes and nonstop monitoring and checking is necessary. In this project are create different types of shapes. The measurement of shapes are very difficult but our project resolve the measurement of the shapes. In this project you get a different types of shapes in seconds. There are various types of monitoring and controlling. . In this project, the method adopted is with the help of PLC .Here the various factors are monitored using sensors and PLC. The HMI use for selecting the shapes.

ACKNOWLEDGEMENT

All praises and thanks to Almighty "**ALLAH**", the most merciful, the most gracious, the source of knowledge and wisdom endowed to mankind, who conferred us with the power of mind and capability to take this project to the exciting ocean of knowledge. All respects are for our most beloved Holy Prophet "**Hazrat MUHAMMAD (Peace Be Upon Him)**", whose personality will always be source of guidance for humanity.

Acknowledgement is due to **Hamdard Institute of Engineering and Technology** for support of this Project, a highly appreciated achievement for us in the undergraduate level.

We wish to express our appreciation to our **Engr. Muhammad Talha Iqrar** who served as our major advisor. We would like to express our heartiest gratitude for their keen guidance, sincere help and friendly manner which inspires us to do well in the project and makes it a reality.

Many people, especially our classmates and team members itself, have made valuable comment suggestions on this proposal which gave us an inspiration to improve our project. We thank **Engr. Naveed-ur-Rehman** & all the people for their help directly and indirectly to complete our project.

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ABBREVIATIONS

PLC = Programmable Logic Controller

HMI = Human Machine Interface

TB = TOSHIBA

ROM = Read Only Memory

I/O = Input

O/P = Output

DRAM = Dynamic Random Access Memory

RAM = Random Access Memory

RISC = Reduced Instruction Set Computer

CPU = Central processing Units

GM = General Motor

DI = Digital Input

DO = Digital Output

NI = Numeric Input

NO = Numeric Output

USB = Universal Series Buses

CHAPTER 1

Introduction

In this chapter we present you the overall synopsis about the hardware and software used in the project. To develop the attention of the reader we as an author make a work to make it as miniature and valuable.

In 1900's, engineers were using wire logic to make the machine as automatic as possible. The design of an automatic machine is a system which is been planned on different level. In past few years PLC's are usually used in many complex machines to make them work automatically. Automation has become a main goal in all engineering field. PLC have ability to use small step by step logic to cover large logical problems. PLC contains its own microprocessor to process and is accomplished of multi-loop. It helps to communicate within the module and can be experimental by the engineer by connecting HMI or calculating various reactions. PLC can be linked to different other modules or card to achieve more efficiency in motor controlling, temperature controlling or to make it easy to operate for the operator.

The function of the automatic wire stirrup bender machine presented in this report is to create different types of shapes like circle, triangle, square and hexagon. In this project use a copper wire to make a shapes the first segment is to feed the wire after that the wire will be detect using sensor after this segments the new segment will start is called bending process and the final segment is cut to wire. The automation of this process obliges to replace the manual human operations previously used to create a shapes .The sub systems are:

1. Feeding System
2. Detection system
3. Bending system
4. Cutting system

1.1 Motivation

In industries it is a great straight forward of designing automatic panels for various machines and it is quite beneficial for engineers for having knowledge of such work. We have practiced that many automatic panels are designed on PLC's and also on microcontrollers but for industrial application PLCs are most desirable. The common reason is because it's much comfortable to program and install. They are appropriate in industrial environment like the continuous vibration and heat

1.2 Problem Statement

Everything is Automatic for industrial use because they need secure and effective results. Industry wants machines that can create more in short time to accomplish their goal in short time. For such determination well-organized stirrup bender are designed to make machine easy to use and to collect fast result. Most of the machines are not that much well-organized than PLC based. There are various reason of PLC based provide fast speed, easy trouble shooting and correct result. Now, human machine interface makes the work rapid to the user to operate. It shows the encouragements of the machine, user can change the factor related like change in size, change in design and many other. That's why we have produced and practiced the PLC based Automatic Wire Stirrup Bender.

1.3 Organization of Thesis

This report documents the detail of "PLC based automatic wire stirrup bender. The suggested project is done by the FATEK-FBs series 20MAT2-ACand the result will show on HMI. The structures are applied on digital of the PLC as per requirement. This includes the application of some sensors and motors. It briefly defines the design and execution of the system. We are discussing all the key of our project in this report that is demanding in the construction industry, and primarily concentrating on the different types of shapes.

1.4 Objective

The Main purpose of the project was to design a different types of shapes with the help of PLC and to control the measurement of wire in this project, various parameters are shown on HMI,

1.5 Methodology

1.5.1 Proposed Work

- To run the motors with the help of PLC
- To interface the sensor
- To develop a system using PLC
- To develop the shapes on HMI

1.5.2 Brainstorming

Each group individual was invited to present their views on

1. Which type of instrument use in this project.
2. Market survey.
3. Buy a components.
4. How to build structure.
5. Features and condition of each element used in the project.
6. Approximate costs.

1.5.3 Interfaced

- Stepper Motor Interfaced
- Dc Motor Interfaced
- Sensor Interfaced

1.5.4 Design and Testing

- Solve problem.
- Challenging phase.
- Testing phase

CHAPTER 2

Literature Review

In order to implement and plan a solution for the problems we want to address, it is required to fully understand the problem declaration. In this chapter, the problem will be discovered by looking at related literature and the related study we did of the different technologies. Current researches which are closely related will be studied, compared and techniques which are appropriate for the project will be known and evaluated.

During construction mostly work is done by labor and it is manually. In small construction sites workers bend stirrup using traditional way like horizontal and vertical rods square, rectangular and circular. There is no other way to make stirrup with less human effort. Needs automation for these all shapes and stirrup bends to decrease the construction time and also human resources Used to reduce labor cost, effort and time. Automated Stirrup Bending Mechanism" (ASBM) using the principles of mechanical and electronic. These all objectives are covered in the project

2.1 What is PLC?

PLC is called programming logic control its also known as digital computer used for the industry to solve the problem. PLC mostly well thought-out to carry on in authoritarian circumstances and protected from heat, dust, cold and moisture etc. PLC depends on microprocessor and programming which is involved in different language.

In PLC programming is written and downloaded operation with via cable. These programming are stored in the memory in PLC. During the move of control panel system of relay the relay of hardwired are swapped on the program are the fed by the user side. The ladder logic are produced by the ladder system and identified by the programming language.

2.1.1 Hardware of PLC

The hardware of PLC are as following.

CPU –CPU is also called the Brain of computer. CPU uses the register to store data and instruction

Memory –There are two types of memory one is primary memory and another one is secondary memory. Primary memory is called is RAM and secondary memory is called is ROM

Input section –Input section are includes sensors, switches etc.

Output Section – Output section are controls the motors, pumps, lightand solenoids valve. The output section are depends on the Reduced Instruction Set Computer (RISC).

Power supply –Power supply is convert electrical power to an electrical load. In our project we use 220VAC or 24VDC power supply

Programming device – The programming device is depends on the processer and memory they feed the instruction in the programming device and sent them to the PLC.

System Buses –Buses are the way to communication the flow of signals in internally.

PLC. The four system buses are:

- Data bus is used to conveyed data to CPU.
- Control bus is used to control the process and works as supervisory.
- Address bus is used to send the location and address.
- Structure bus are medium between input and output for communication.

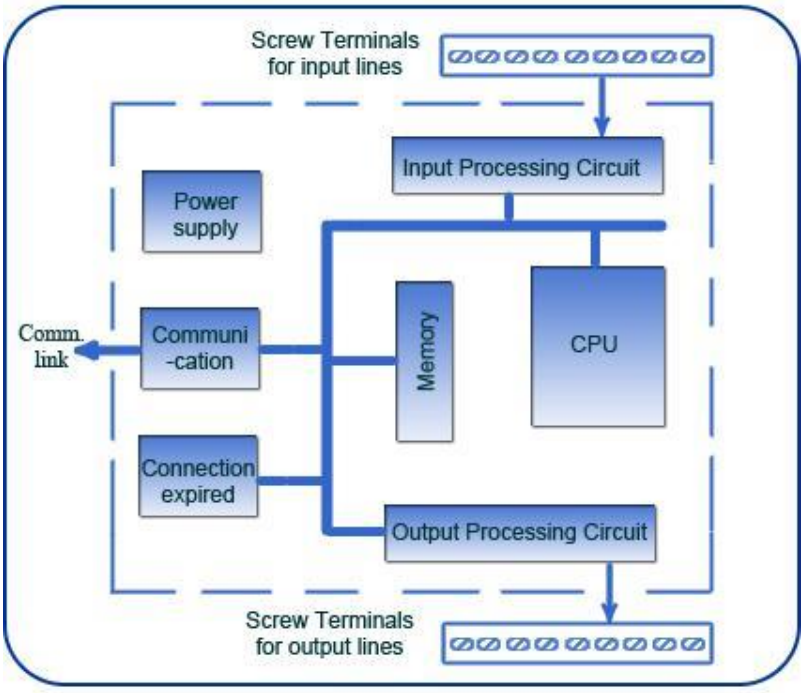

Figure 2.1 PLC Architecture

[https://www.isa.org]

2.1.2 PLC History

The PLC is known as (Programming Logic Control) has developed to automate the industry. Now a day's PLCs are work for automated the industry equipment and machinery, but the old PLC aren't control the procedures in a proper way. Alternative way of happened was a unique set of challenges that needed a solution. The realization of the history of PLC we must to able to understand the problem that is occur in PLC.

During the previous time of the PLC there is only one way to control the industry from relay. Relays working depends on coil. Relay are known as switches that open and close the circuit with the help of electro mechanically .The switches depends on NO (Normally Open) Or (Normally Close) When the relay contacts is normally open the relay is not energized .When the relay contacts is normally close the relay is energized. For example: If I wanted to control the motor whether motor is on or off the relay will attach between the power source and the motor. After that I can understand where motor is energized or not energized. Without power the motor will not start after that adjusting the motor speed. This types of relay is called power relay. There are several motors are in used in industry how what we do for controlled this motor. You add a lots of power relay. So after this the industry unit will be accumulating to power relay by electric cabinet. Think about that which power relay contacts should be normally close (NC) and normally open (NO) to turn on the motor normally open. So, what we will do to control the motor. This relays are called control relay because they control the relay which contact will open or close for start the motor.

Assume about present industrial unit and how many switches are required to ON and OFF the motor and that we have need to control for one machine. Addition of all control relay necessary and what you get that called machine control, but find a logistical terrible. These relays are depends on the hand wired and they are connected with another relay if one relay are occur issue the another relay are also damaged and the whole system are not work. In relay the trouble shooting take a plenty of time. The relay coil failed during this time and the relay need plenty of trouble shooting and the size of this machine is large because of combination of relays and they take harsh maintainers. After this we need to rebuild the system because of one issue . It almost immediately becomes perfect that here problems are situate up and preserving and control in large system.

In the relay base system are include in the control system is more than 50 or 100 to control the system. The control system of electrical appendixes to accommodation the system are six feet high by six feet wide, mount near the control system. The plenty of wires hustled and together to control the system and industry equipment like timer, counter and sensors they are very compact in size. The same wiring after few months and years engineering will change that because the wiring is depend on the engineering they will wiring with own system the another will never understand the wiring and the wiring being out of the wire channel or undone; in many cases wires adding to an existing in a zigzag, and straight to the point example and they take the nonstop route and plenty of time to make the modify .The additional operation engineering that referred to control the system dependability, suffered along with rise the difficulty of during trouble shooting time

So what's the right solution? So I am confident of this accurate question. The engineer developed the automated the division of General Motors was under pressure with on a daily basis At the same time the idea of controlling the computer had taking place to make its own communication with the large organizations such as General Motor. According to the father of PLC Dick Morley the program are introduced during the year 1968.The summary of a record that General Motor (GM) engineers place out to the control system Dick Morley are request to the own company, and they planned and introduced the PLC instead of the relay control system, and they wanted to listed the GM to control the system a solid state system that was flexible like a computer but priced competitively with a like kind relay logic system.

Simply maintain and automatic and already established relay ladder logic system are technique of doing things and it depends of the industrial environment. The industrial environment are some time moisture, dirt and including of electromagnetic vibration. It have to be modular to easily exchange the components and expendability.

The training give the impression of being PLC necessary that it would be easily understand and use for maintain the electrician and engineer. The relay based control systems are complex because depend of plenty of physical module and involve the wiring diagrams also develop gradually in the relay logic control system that are showing in a ladder mode. The control system are depends on hot wire the left of the hot wire and the right side of the wire is control the poor in railing system. The relay depends on the equipments like limit switch, push button contacts, the motor coils and the soliend valves etc.

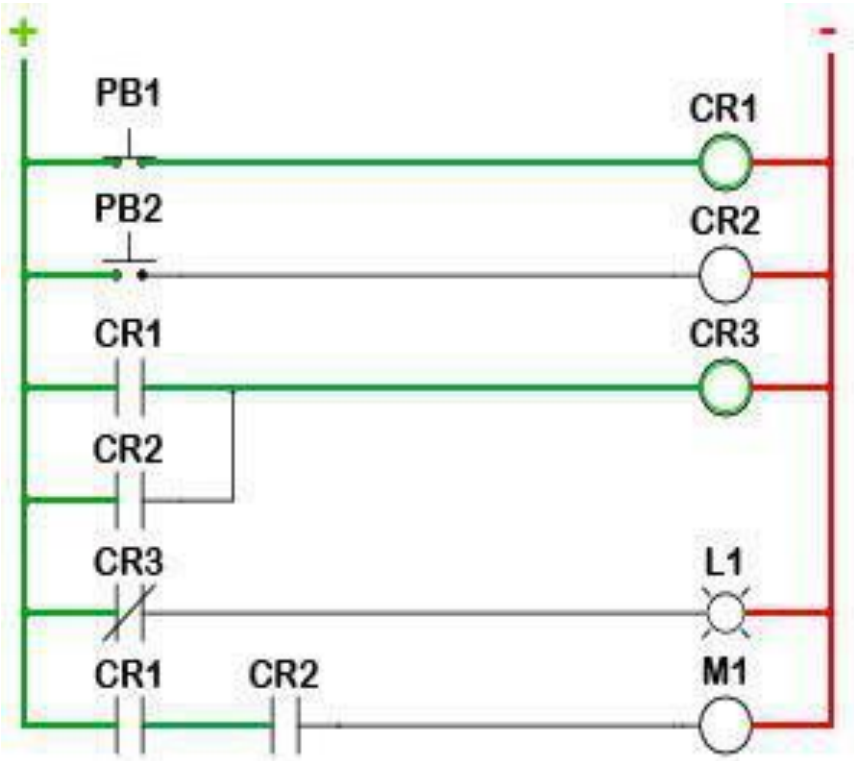

Figure 2.2 Structure of Ladder Logic
[https://library.automationdirect.com/understanding-ladder-logic/]

As Dick Morley passionate expression in his record, the procedure from proposal to concrete the controller that was not all soft sailing. The original system that was not delivered just have 125 words of remembrance and speed criteria was not mentioned during the proposal time . You can visualize that what happened at this time. First, we directly run out of remembrance, and second, the machine will relaxed perform any function anywhere near the relay response time. Relay response times are more than 1/60th of a second, and the topology shaped by many cabinets full of relays transformed to code is meaningfully more than 125 words. We extended the memory to 1K and thence to 4K. At 4K, it stood the test of time for quite a while.

The designer control Tom will recounts at the same time they create my knowledge for the relay based control system and they put me in the perfect position to be single of the first control system originators to utilize some of the very first programmable controllers to replace relay based control systems. My first experience of a PLC occurred to be with one of the associate competitor Bedford in a solid state device and the section was with a suitcase sized programming device that setting the required instruction type and the line address and after that demanding button to connect a burn

fuse with the open link in a memory chip to set a logic path.The programming is completed the tested the PLC have able to take the action and accomplish the machine cycle and operate in a very dependable method. Incorrectly the card rack of PLC is open with a uique way and it is a combination 24Volt DC and 120Volt AC. That may not have required a much time for an engineer checking signal during the troubleshooting time when the PLC short during this time the entire PLC will not work. Individual the exercise of a PLC in a huge industry the breakdown destined the make use of PLC at this industrialized ability for a sequence of year.

Finally Dick Morley corporate the spin off a business with the name of a Modicon they introduced the first PLC with Modicon 084(08 means its prototype that was the Modicon084 that was represented the GM and meet the criteria of standard machine controller presented to GM to meet its criteria for its standard machine controller. The Modicon sell the prototype with a very limited. The company learn and grow ultimately Modicon change the industry forever and bring a life controller that would change the industry and Modicon writes this about 184.
The company of Modicon and the programmable controller really takes off was not the 084 its was the 184. The 184 is completed the plan by Michael. That was the one of best engineer I have ever meet The Michael and lee is the chief of the dealer rise with the requirement and designed the device to automated the business. They build 18 over the complaints of yours truly company. That was the magnificent and effected design

2.1.3 PLCs Advantages

PLC gives us lot of profits like interfacing individual plant, plants to computers and provides latest factory automation. It is easy to connect all the parts within the machines. The parallel connection be responsible for us better path to trouble-shoot problems. In PLC at times machine want to perform same tasks. And PLC has capacity to process data and answer quickly in real situations. This makes it well-organized at rapid response machine. When all the data is presented for processing a PLC can connect directly to the host computer to read all the parameters which are required for processing, to this side of the PLC “engineers” offers networks that can be able to install. PLC provides the ability to spend the control system almost any changes can be made in the process as per condition by adding many modules or software. With the calculation of the new modules in the PLC control system it is also easy to keep and trouble-shoot the system in a very short time that is proven to be very dependable and of high quality.

2.1.4 PLC Disadvantages

Too a lot effort essential worked are required in involving chains. A plenty of complexity with change or substitutes. That for all time complexity to uncover error and need skilled effort strength. When in this system the problem occur hold up and time is undefined.

2.2 Monitoring and Controlling Techniques

For complete understanding of the "PLC based Automatic Stirrup Bender" we first have to appreciate the base steps which are taken for this project. The overall process is divided into following phases:

3 Feeding

4 Bending

5 Cutting

In the first step the feeding is done by the stepper motor that feed the wire and the second phases bending the wire the bending process is adopted with the help of stepper motor and a shaft at last the cutting process is done with dc motor.

CHAPTER 3

Experimental Setup and Procedure

3.1 System Block Diagram

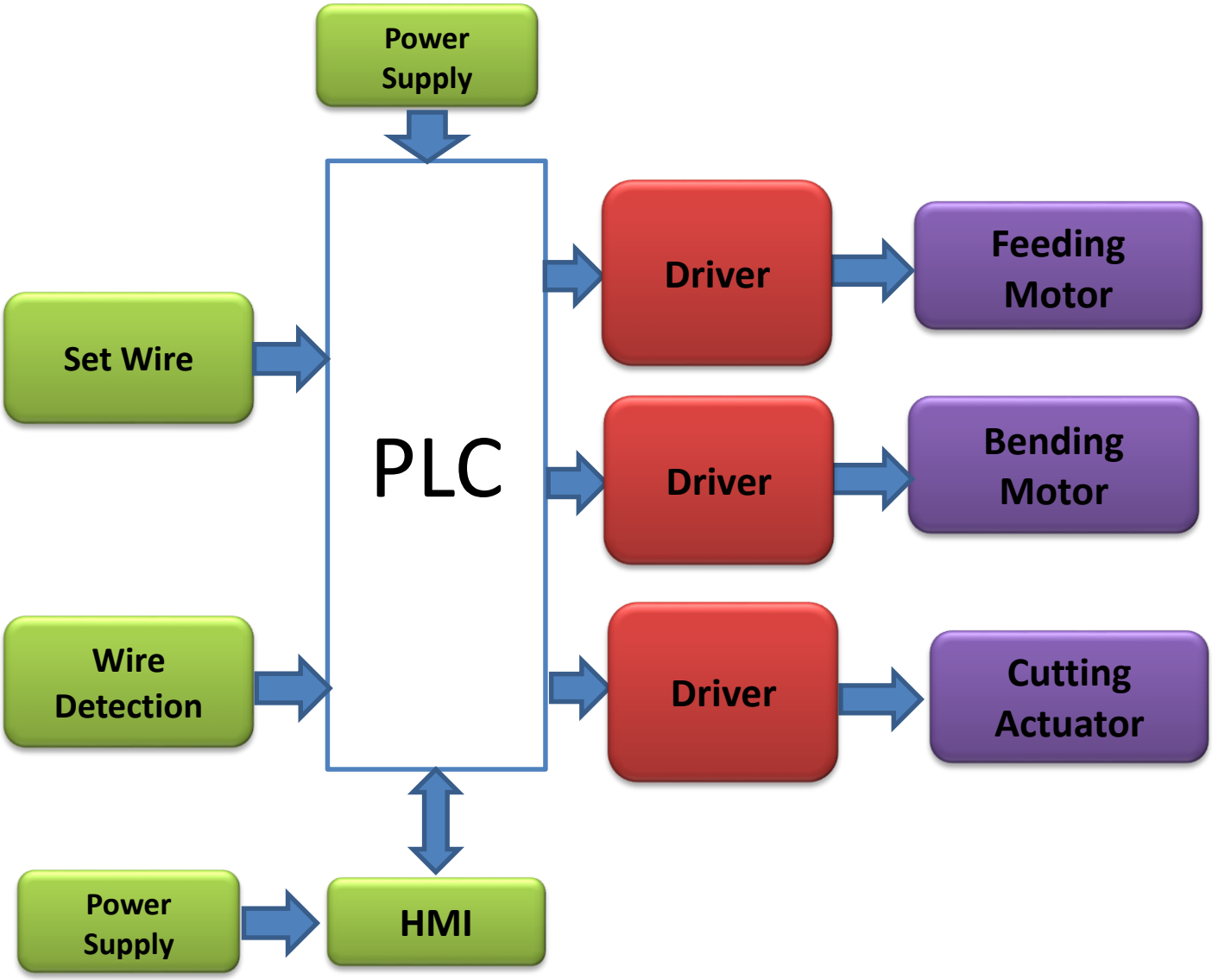

Figure 3.1 System Block Diagram

3.1.1 Explanation

1. Power supply

A power supply convert AC in to the low voltage to regulated the DC circuit The main purpose of power supply is to change a current from a source load, and to correct the frequency, voltage and current to the power load.

2. Push Button Switch

A push button is known as simply button it is used to ON or OFF the mechanism in a machine or in a process. They are made up of different type of material like hard, plastic and metal

3. Wire Detect Sensor

Wire detect sensor is used to detect the wire.

4. Driver

A driver is used to control another circuit it is a electronic components and they have a ability to control the another module.

5. Motors

A motor is an electrical machine that changes electrical energy into mechanical energy

6. PLC

The output of each digital sensor such as vibration and RPM is straight is given as input to the PLC and the output of other sensors which are analog such as voltage, current and temperature is given to the Analog Module. The output of PLC is response to the contractor for the alarm response.

7. HMI

Finally, results of working parameters effected over shapes are monitored and controlled through HMI.

3.2 Hardware

For designing our system we used the following components.

- PLC FATEK FBs-20MAT2-AC
- Weintek HMI (MT6070iH)
- Power Supply
- Push Button Switch
- Stepper Motor
- Driver
- DC Motor

3.3 PLC FATEK (FBs-20MAT2-AC)

The fatek is called new generation of micro PLC prepared among outstanding purposes like Large and Small PLC that have more than five communication port. Fatek PLC are depends on the digital input(DI) and digital output(DO) that have 256 (DI) and(DO) and 64 words of numeric input(NI) and numeric output(NO) . The main units of FBs are follow three type.

1. MA (Economy type)
2. MC (High Performance)
3. MN(High speed)

The speed of fatek PLC is 20khz that have 24 points and 24Vdc (6 pints speed is180khz). 16 points have relay and transistor output. RS323 or usb port . built in RTS for terminal block removable.

Figure 3.2 FATEK PLC (FBs-20MAT-AC)
[https://www.amazon.com/Fatek-PLC-Controller-FBs-20MAT2-AC-FBs-20MAT/dp/B015SWQEWM]

3.3.1 Specification

Table 3.3 FATEK PLC Specification

Model Specifications

Basic main units (MA)

Spec. \ Model			FBs-10MA	FBs-10MAT	FBs-14MA	FBs-14MAT	FBs-20MA	FBs-20MAT	FBs-24MA	FBs-24MAT
Digital input	24VDC	Medium low speed (total 5KHz)	4 points							
		Low speed	2 points		4 points		8 points		10 points	
Digital output	Relay	AC/DC(2A)	4 points	—	6 points	—	8 points	—	10 points	—
	Transistor (5~30VDC)	Medium speed 10KHz (0.5A)	—	4 points	—	4 points	—	4 points	—	4 points
		Low speed (0.5A)	—	—	—	2 points	—	4 points	—	6 points
Comm. port	Built-in		1 port (Port0, USB or RS232)							
	Expandable		2 ports (Port1 ~ 2, RS485 or RS232 or Ethernet)							
Calendar			option							
Built-in power supply			POW-14(AC)/DPOW-10(DC)				POW-24(AC)/DPOW-16(DC)			
Wiring mechanism			7.62 mm terminal block							
Dimension			Figure 2				Figure 1			

Item		Specification	Note
Execution speed		0.33uS/Sequential instruction	
Program capacity		20K Words	
Program memory		FLASH ROM or SRAM + Lithium battery for Back-up	
Sequential instruction		36 instructions	
Function instruction		326 instructions (126 kinds)	Include derivative instructions
Flow chart command (SFC)		4 instructions	
Communication Interface	Port 0 (RS232 or USB)	Communication speed 4.8Kbps ~ 921.6Kbps (9.6Kbps)*	
	Port 1 ~ Port 4 (RS232, RS485, Ethernet or GSM)	Communication speed 4.8Kbps ~ 921.6Kbps (9.6Kbps)*	Port1 ~ 4 provides FATEK or Modbus RTU/ASCII or user defined communication protocol
	Maximum link stations	254	

3.4 Weintek HMI (MT6070iH)

The HMI in our project is used (MT6070ih). MT6000 series is the new generation series in weintek with the new ideas assemble the customer segment and fulfillment the customer segment and easu to use while MT6000 pay as a role of data exchanges center. MT6070ih port name is USB 1.1 host and USB 2.0 host with high speed device.

Figure 3.4 Weintek HMI (MT6070iH)

[http://www.yonung-iat.com/i-series/25-weintek-hmi-mt6070ih.html]

3.4.1 Specification

- Structure construct from plastic
- 7inch display 655363 colors
- CPU 32Bit
- Core logic 400Megahz processor
- DRAM: 64 MB DDR2 on board s
- 128 MB storage flash memory on board.
- 3-serial I/O
- RS232orRS485 2wire/4wire –com1
- RS232-com2
- RS232orRS-4852wire-com3
- 1 USB 1.1 host
- 1 USB 2.0 high speed device
- RTC: Built-in
- 24,20%vdc, 250mA-power input
- Dimension (200 x 146 x 42.5mm)
- 0.85kg weight
- EB8000 V2.0.0-software

3.5 Power Supply

Power Supply is known as electrical device that deliveries electrical load form electrical power. The major purpose of a electrical device is to convert electrical load from a source into a right frequency, right current and right voltage and some power supplies are converted power and some are isolated are in piece of tolls and while other are assembled in to the appliances. Examples of power supplies some assembled in computer. Another major purposes that the device may accomplish take in preventive the current exhausted as a result in load and free risk level .The power supply work at the in the form of input attainment the load, correction of power factor and keeping current so it can keep on to power the load in the incident of a brief intermission to the power sources power supplies have a input system that have accept input from the user in the from of energy and power supply output convert energy in the form of carry current in the load..

Figure 3.5 Power Supply (24v to 5v)
[https://www.dx.com]

3.6 Push Button

A push button is known as simple button or a simple switch that have a ability to controlling instrument in a machine or in a process. Buttons are consists two types of material soft material and metal material. The push button surface is very smooth or shaped as fixed to the human hand and finger so that has to easily and without difficulty press or empress. Simple switches are used include pressing and depressing .The simple switch will be applied and used in calculators. Push Button are utilize in home, industry and various electronic and mechanical system.

Industrial uses of simple switch could be there associated mutually through mechanical connection so they act as a pushing and released button. In the other way stop button could act as a start button to be released. This technique of relationship is use in easy physical operation in that machine or process system have no electrical circuit of control.

Red push button are used in project and that have a head called mushroom head that have easy to used for a operation and have easy to stop the motor these button are called stop button. And red is used for stop and increase safety major in the process in the control of electrical circuit.. This huge expand shape can also be found in buttons for use with operatives who need to uses gloves for their work and could not put into action on a usual flush-mounted push button.

Figure 3.6 Push Button

[file:///C:/Users/TEMP.HAMDARD.004/Desktop/B006M3GEOA.htm]

3.7 Stepper Motor

Stepper Motors are usually worked as a open loop control system .Instructions define the particular association of the Stepper Motor. In some cases stepper motor can lose and stall due to quality issues or unanticipated work at the same time as it is unusual incidence, the chances a drawback for a steeper motor technology. Stepper motor as well as worked in a closed loop configuration. On the other hand this results are very costly. Stepper motor have a poor toque during high speed. At this stage the micro stepping will be improved on the other hand except stepper motor are cast-off in closed loop.

Figure 3.7 Stepper Motor
[https://www.sparkfun.com/products/10846]

3.7.1 Stepper Motor Operation

Stepper Motor are also offer speed control and positioning control without any use of feedback. Basically the operation of stepper motor is directly proportional to the rotation of shaft rotation is perform in degree and the time to facilitate a outline for each shaft pulse is convey and you can control the positioning and speed with the control of shaft pulse. The motor rotor are provide the torque and communicate between the magnetic field in between stator and rotor . The magnetic field strength is directly proportional to the number of turns in the winding and quality of current delivered in the stator and rotor. Stepper Motor are consist of multiple "toothed" electromagnets arranged from one place to another a inner shaped piece of iron. The armature are tear up by an external circuit and micro controller To create tto the chance of motor, First the electromagnetic provide power to the to the magnetic field that move the gear teeth of stepper motor the gear teeth are associated with the first electromagnetic that little offset from the next one electromagnetic .The rotation of gear is depend on the next gear and the previous gear. The same procedure is repeated. Each rotation of stepper motor is called step and the rotation of stepper motor is consist of integer number to make the full of rotation. In this rotation the steppermotor is rooted between the angle.

The arrangement of circular electromagnetic is disturbed the each group of phase and is called phase and the phase is depend on the number of electro magnetic. The stepper motor designed is preferred by the number of group. The each group of electromagnetic is enclosed with the other group of electromagnetic for example if you have two grouped of stepper motor A and B and five turn of electromagnetic system the grouping pattern of the stepper motor is ABABABA the same group of electromagnetic are energized together. Because of stepper motor is required more phase and wire to control the load .

3.8 Driver (TB6560)

The TB6560 is the driver of stepper motor outstanding working on micro stepping that is called TOSHIBA (TB6560). The TB65650 is based on pure sine current control technology group to the visual projection control technology and also called self-adjustment technology which means that have self-adjustment parameters according to different motors and run the motor is very smoothly with low noise and protected from heating and that have a well performance high speed. It is appropriate from running 2 phase and 4 phase hybrid stepping motor.

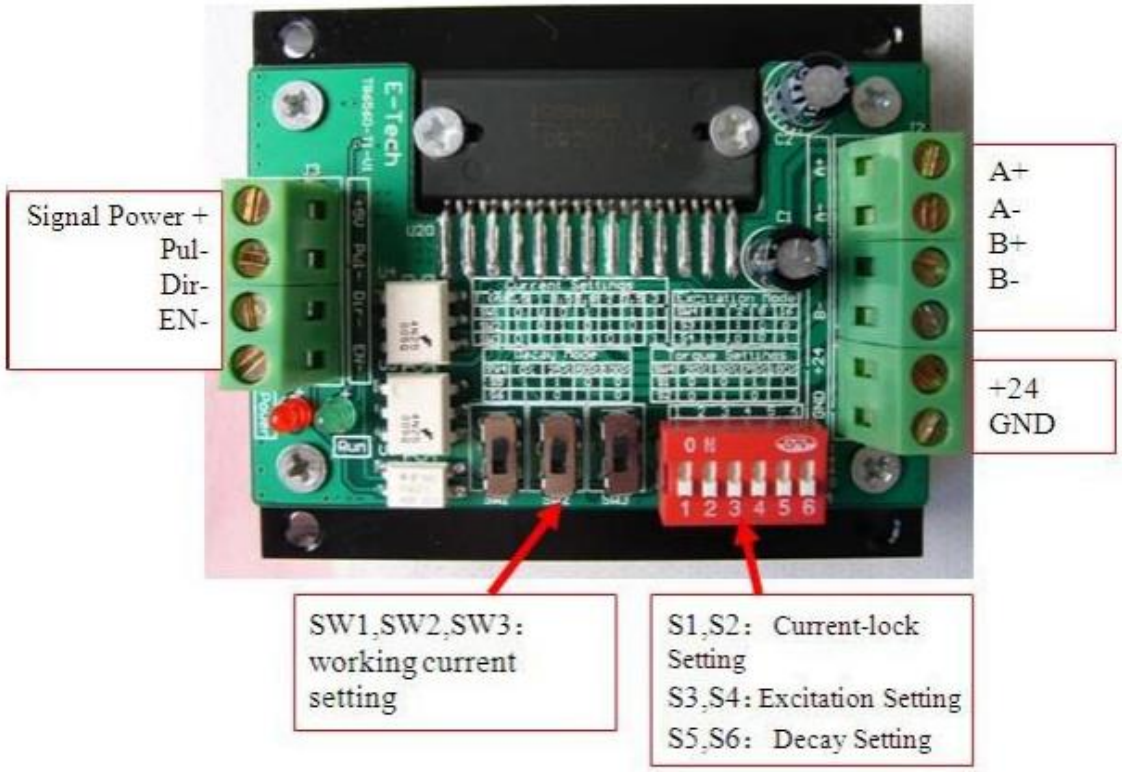

Figure 3.8 Driver (TB6560)

3.8.1 Features

- Low Cost
- Good speed torque
- Up to +32 supply voltage
- Frequency up to 20KHZ
- Used for 2phase or 4 phase
- Output current 3.2A
- 3200 rev step
- Protected from over voltage
- Protected from over heating
- Slim size

3.8.2 Application

Appropriate for a wide range of stepping motors from NEMA size 17 to 23. It can be recycled in various kinds of machines, such as labeling machines and laser cutters. Mostly adjust to the applications preferred with low vibration high speed and high accuracy.

3.8.3 Specification

Parameters		TB6560-3AXIS			
		Min	Typical	Max	Unit
Output current		0.6	-	3	A
Input voltage		7	24	32	VDC
Inner Frequence		640		20000	Hz
Outer input frequency		0	-	16000	Hz
Connector Voltage	H	4.5	5	5.5	VDC
	L	0	0	0.5	VDC

Table 3.8 Specification Driver (TB6560)

3.9 DC Motor

A DC motor is called classy of rotation to electrical machine that convert current into the electrical energy to mechanical energy. The a large amount familiar form of relay that depends on the magnetic field. almost all kind of Dc motor include a quantity of internal machinery, whichever electromechanical or electronic to every so often transform the flow of current into the direction of motor.

DC motor first time used in they could be powered up from the present direct current lighting to the power supply system. The control of the speed of the DC motor have some technique using variable supply by changing the power of current in the field winding. Small dc motor is used in toys , tools and home appliances.

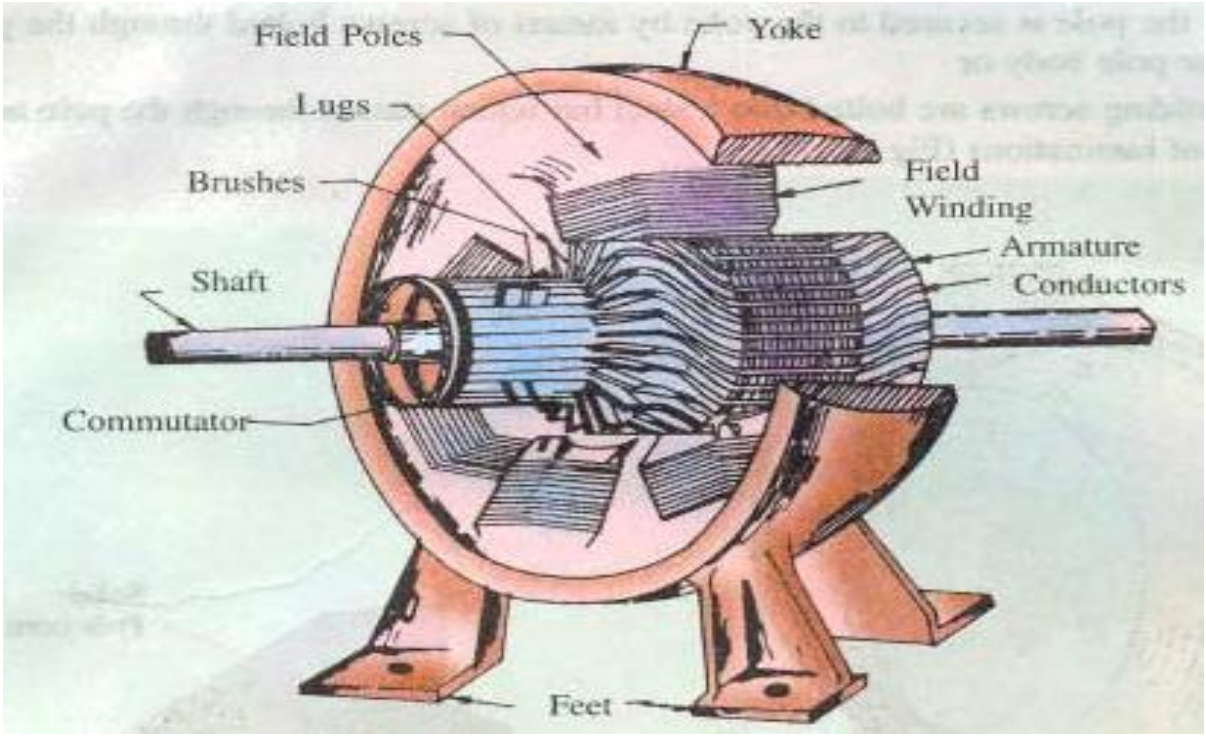

Figure 3.9 DC Motor

[https://www.top-ee.com/series-wound-dc-motor/]

3.9.1 DC Motor Working

Study a piece of a multiple DC Motor working as shown in Figure below. The motor terminal are associated with an external source of the DC supply the field magnet are excited emergning alternative north pole and south pole that convey current to the armature. The flow of current North pole convey currents in single direction while all the flow of current under South pole convey current in the differing path.

Understand the flow of current under North pole convey current keen on the surface of the paper and those under South pole convey current not in of the level surface of the term paper because every framework flow of current is moving current and is located into the magnetic field and the mechanical force are turn on . The left hand rule are clear the rule of flow of current thaow of current this have a tendency to switch the anti-clockwise to the armature. All type of the services enhance in concert to create a heavy moment of force when the rotation of armature. After that the flow of current is changing from one direction to the another of brush direction thus the current in that flow of current is retreated at this similar time it come underneath the impact of next pole that have a reversed polarity. After that the direction of force of flow of current is equal and it be supposed to be prominent that the purpose of a commutate in the generator and as same in the motor

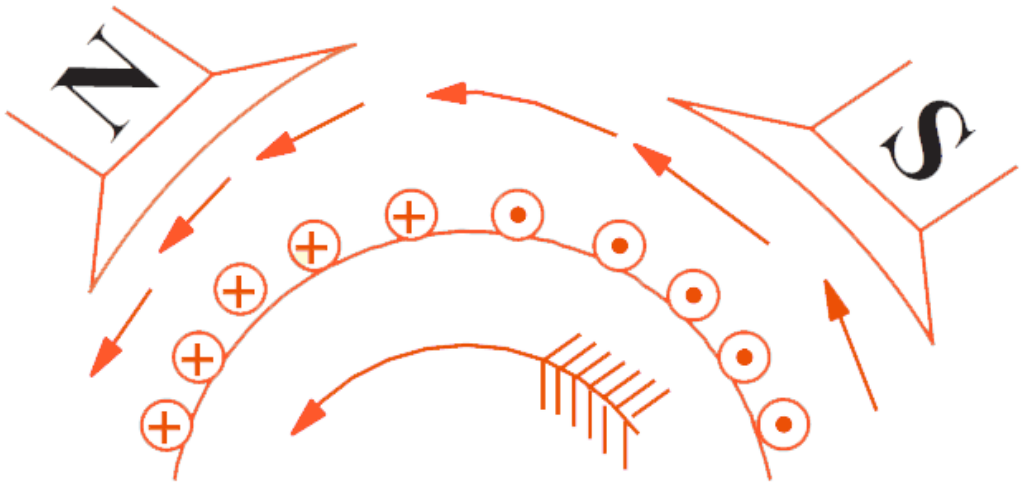

Figure 3.10 DC Motor working

3.10 Software

3.10.1 WinProladder

This software is only for FATEK PLC; procedure to figure ladder logic and simulation and online purpose. Can pretend the ladder program of implementation instead of Fatek connection. That given that the single, multiple and continuous scan mode the implementation of result of the each scan mode is simply check. That provide that programming concentrate on divide and information cut-off point, that was suitable to ensure any in-between implementation consequence and to classify any information distorted. Offers statement allow peripheral curriculum or machine to adapt or display the changeable during the reproduction. That time deletion attribute, through the imitation development the curriculum could be adapted with no discontinue the implementation

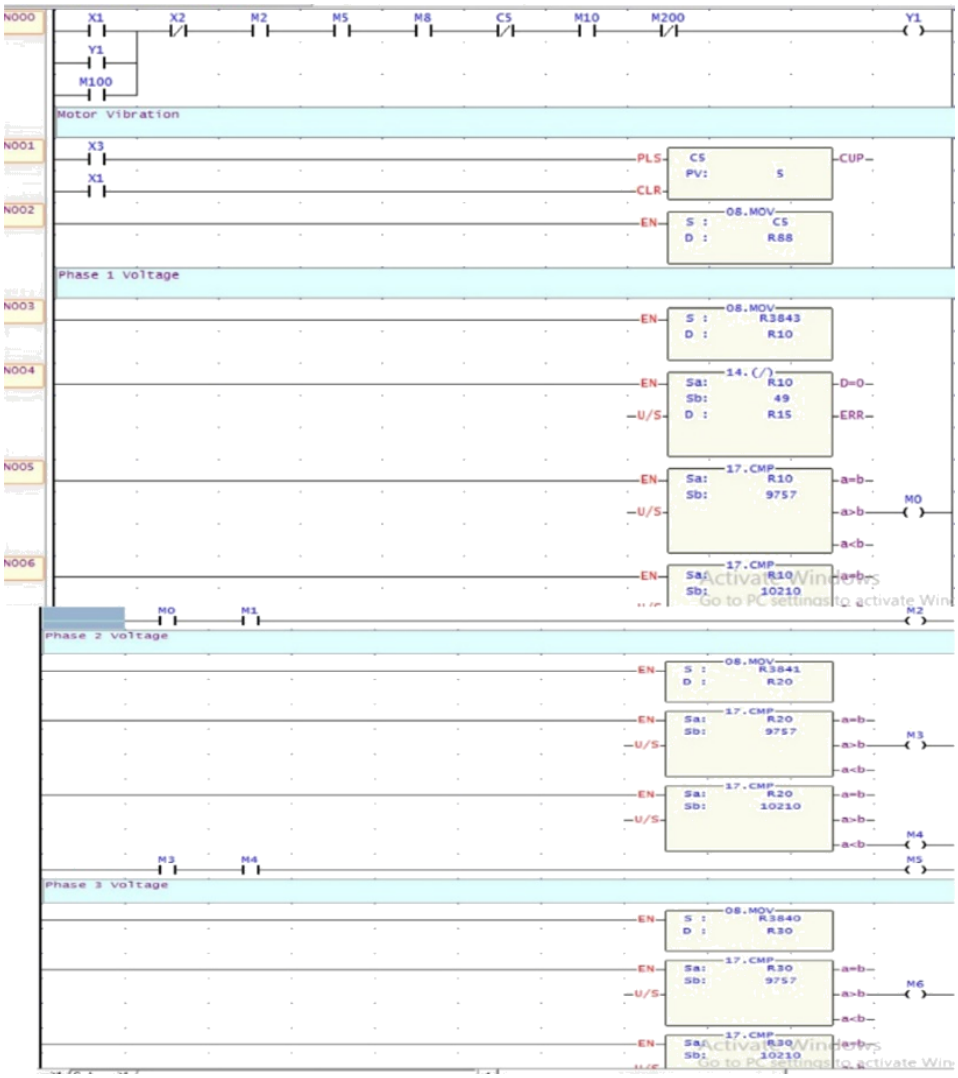

Figure 3.11 PLC Programming

3.10.2 Easy Builder

Software: Download Easy Builder Pro configuration software from Easy Builder Pro CD or visiting Weintek Labs, Inc.'s website at http://www.weintek.com to get all software versions available and latest advanced files**.**

Figure 3.12 Easy Builder

3.10.3 Operating System

1. Windows 2000
2. Windows NT
3. Windows XP
4. Windows Vista
5. Windows 7

CHAPTER 4

Experimental Results and Discussion

4.1 Hardware and Instrumentation

Hardware contains of Motor, PLC and other mechanisms like push button, sensor and driver. Hardware connections can be seen below in figure 4.2 and 4.3 In this project sensor is used as metal detect device which detect the wire and motor is used to feeding ,bending of the wire and driver is used to drive the motor and at the end when shapes are made the dc motor is used as a cutting actuator.

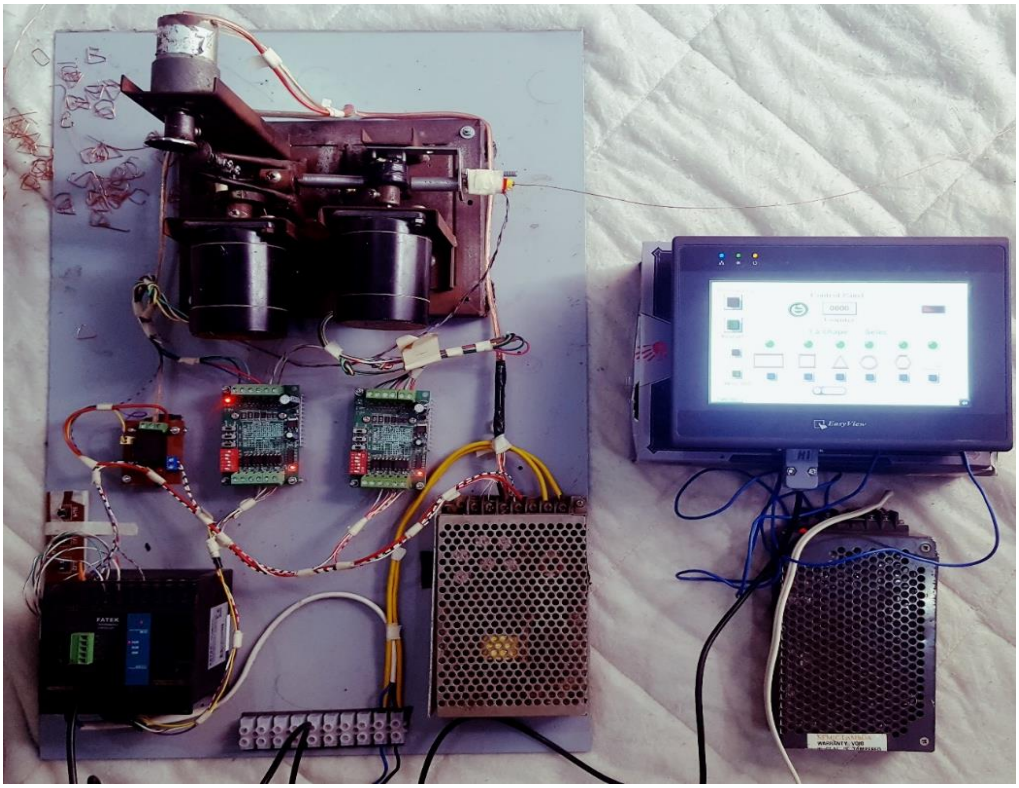

Figure 4.1 Assembled Hardware

4.2 Results on HMI

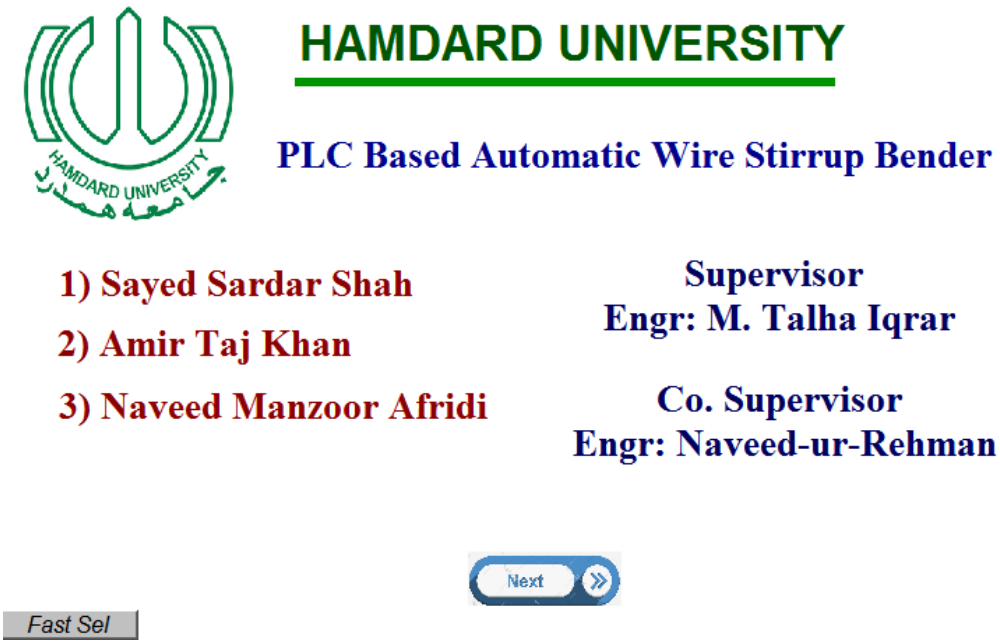

Figure 4.2 Title

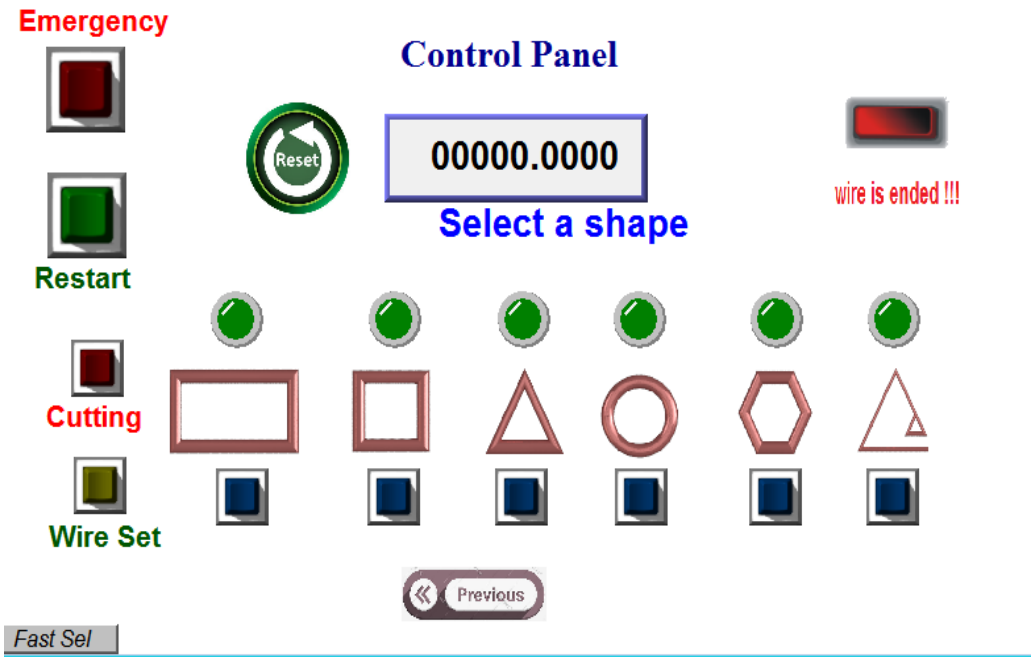

Figure 4.2 Control Panel

Chapter 5

5.1 Conclusion

After all the work that has been accepted out during the project we have concluded that we have achieved the entire task given to us by the supervisor Engr. Muhammad Talha Iqrar and co-supervisor Engr. Naveed-Ur-Rehman we have successfully fulfilled the design of "PLC Based Automatic Wire Stirrup Bender" by using PLC FATEK (FBs-20MAT2-AC), HMI Weintek (MT8000), Stepper Motor, sensors etc.

Our Project fixes all the working as said in the proposal as well in the report above. Different mechanisms of the system are calculated in such a way that is easily scalable with minimum efforts, so improvement can be done in upcoming extensions of the project easily

A Motor has been associated to the monitoring and control system with the help of various measuring components. Similar kind of work can be done with the help of Arduino and further corrective measures can also be taken care off while designing such systems. Other types of faults can also be considered such power factor problems ground faults.

5.2 Recommendations for Future Work

Similar kind of work can be done with the help of DCS, Arduino etc. and further corrective measures can also be taken care off while designing such systems. Other types of faults can also be considered such power factor problems ground faults

In future work, several changes can be made to improve the system and make it more reliable and powerful.

1. Advance Monitoring.
2. Better animation on HMI
3. More Complex Shapes includes
4. Scanning System are includes
5. Use of IP cam for monitoring

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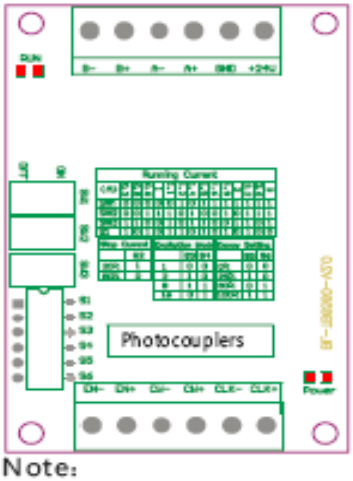
Appendix

A. Stepper Drive

Tb6560 stepping motor driver V20



Warning:

1、Check the connection twice! The Tb6560 chipset can be damaged if the motor or the power supply are not connected properly.
2、Dont apply a motor that its rated current is more than 3A to this driver.
3、Do not set the current more than the motor rated current!

Wiring Terminal symbol	Description
+24V, GND	Power positive and negative
A+, A-	Motor phase A
B+, B-	Motor phase B
CLK+, CLK-	Pulse positive and negative
CW+, CW-	Direction positive and negative
EN+, EN-	Enable positive and negative

Note:

1、6 input terminals, can be connected as common anode or cathode.
2、The normal input voltage is 5V, if it is more than 5V, than a series resistor is needed. this resistance is 1K case 12V and 2.4K case 24V.
3、when pulse is applied to CLK, the stepping motor will rotate, and stop when there is none, and the motor driver will change its current to the half current mode as setting to hold the motor still.
4、Motor rotate clockwise when CW is low level and counterclockwise when CW is high level.
5、Motor is enable when EN is low level and disable when EN is high leve.

Running Current														
(A)	0.3	0.5	0.8	1	1.1	1.2	1.4	1.5	1.6	1.9	2	2.2	2.6	3
SW1	OFF	OFF	OFF	OFF	OFF	ON	OFF	ON	ON	ON	ON	ON	ON	ON
SW2	OFF	OFF	ON	ON	ON	OFF	ON	OFF	OFF	ON	OFF	ON	ON	ON
SW3	ON	ON	OFF	OFF	ON	OFF	ON	ON	OFF	OFF	ON	ON	OFF	ON
S1	ON	OFF	ON	OFF	ON	ON	OFF	ON	OFF	ON	OFF	ON	OFF	OFF

Stop Current	
	S2
20%	ON
50%	OFF

Excitation Mode		
Step	S3	S4
whole	OFF	OFF
half	ON	OFF
1/8	ON	ON
1/16	OFF	ON

Decay Setting		
	S5	S6
0%	OFF	OFF
25%	ON	OFF
50%	OFF	ON
100%	ON	ON

B. Stepper Motor

Stepper Motor Specifications	
Mosaic Part No.:	STEPMOT-1
Manufacturer Part No.:	42BYG228
Size:	NEMA 17
Drive system:	Unipolar
Step angle:	1.8° full step 0.9° half-step
Phase/Windings:	4/2
Voltage & Current:	12V at 400 mA
Resistance per Phase:	30 ohms
Inductance per Phase:	23 mH
Holding Torque:	2000 g-cm
Detent Torque:	220 g-cm max
Weight:	0.24 kg (0.5 lbs.)
Max continuous power:	5 W
Rotor Inertia:	22 g-cm^2
Bearings:	Ball
Leads:	18 in. 26 AWG UL 1007
Insulation resistance:	>100 MΩ at 500VDC
Dielectric strength:	500V 50Hz/minute
Mounting hole space diagonal:	1.73 in.
Mounting screws:	3 mm dia. 0.5 mm pitch
Shaft diameter:	0.197 in. (5 mm)
Motor footprint:	1.7 in. × 1.7 in.
Motor height:	1.5 in.
Ambient temperature:	-10°C to +55°C

C. HMI

MT6070iH

Human Machine Interface with 7" TFT LCD display

◆ Features

- 7" 800x480 TFT LCD
- Fan-less cooling system
- Built-in flash memory and RTC
- NEMA4/IP65 compliant front panel
- LED Back Light
- One USB Host and one USB client port
- Power Isolator inside
- Com1 RS485 supports MPI 187.5K

【Introduction】

MT6000 series is the new HMI generation of Weintek. With the design concept of meeting customers' satisfaction while easy-to-Use attribute as before, a MT6000 not only performs as a Human Machine Interface but also plays as a role of data exchange center. MT6000 series is the best choice for your requirement tomorrow.

The MT6070iH is equipped with a USB 1.1 host, and a USB 2.0 high speed device.

◆ Specifications

- **Construction:** plastic molding housing
- **Display:** 7" 65,536 color TFT LCD
- **CPU and core logic:** 32Bit RISC 400MHz processor
- **DRAM:** 64 MB DDR2 on board
- **Storage:** 128 MB flash memory on board,
- **I/O:** 3 serial ports:Com1: RS-232/RS-485 2w/4w,
  Com2: RS-232,
  Com3: RS-232/RS-485 2w
  1 USB 1.1 host
  1 USB 2.0 high speed device
- **RTC:** Built-in
- **Power input:** 24±20%V_{DC},250mA@24VDC
- **Dimension (W x H x D):** 200 x 146 x 42.5mm
- **Weight:** 0.85kg
- **Software:** EB8000 V2.0.0 or later

◆LCD Display

Display type	**TFT LCD**
Display size (diagonal)	**7"**
Max colors	65536
Resolution	800 x 480
Pixel pitch (HxV, mm)	0.1905 x 0.0635
Viewing angle (°)	70/50/70/70(T/B/R/L)
Luminance (cd/m²)	500
Backlight	LED
Backlight Life time	30,000 hrs.
Contrast ratio	500:1

◆ Touchscreen

- **Type:** 4-wire, analog resistive
- **Resolution:** continuous
- **Light transmission:** above 80%
- **Life:** 1 million activation minimum

◆ Environmental Specifications

- **Operating temperature:** 0°~ 50℃ (32°~ 122℉)
- **Storage temperature:** -20°~ 60℃ (-4°~ 140℉)
- **Relative humidity:** 10% ~ 90% @ 40℃, non-condensing
- **Shock (operation):** 10 to 25Hz(X,Y,Z direction 2G 30minutes)
- **CE/FCC :** Complies with EN 55022:2006,Class A
  EN 61000-3-2:2006
  EN 61000-3-3:1995+A1:2001+A2:2005
  EN 55024:1998+A1:2001+A2:2003
- **Front panel meets NEMA4 / IP65**